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EFFECT OF SHRINK WRAPPING ON SHELF LIFE OF BANANAS

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ABSTRACT

Mature green locally available bananas (Chakkerkeli) were pretreated (hot water 50 °C; 10 min) and shrink wrapped in shrink films of polyolefin 15 µ and cryovac 9 µ and stored at ambient storage conditions (Temp = 33°C; RH 72%). An experiment was conducted, both for fingers and hands; periodical observation was recorded in % weight loss, firmness, colour, percent decay and the CO2 transmission rate of stored bananas. The PLW increased gradually in banana, during the storage period. Hands wrapped with polyolefin 15 µ, recorded the lowest weight loss of 1.72%, followed by hands wrapped with cryovac 9 µ. Unwrapped fingers recorded more weight loss (27.48%) compared with wrapped fingers by the end of storage period. The fruit firmness followed a declining trend because of the softening of fruit tissues. Hands wrapped in polyolefin 15µ recorded highest firmness (3.65 kg). The Colour of the fruits changed slowly from green to yellow. The highest colour change from green to yellow was recorded with unwrapped finger bananas and the lowest was observed with hands wrapped with polyolefin 15µ. Decay percentage increased gradually, during the storage period. But, the rate of decay was faster in unwrapped treatments. The CO2 transmission rate increased, with the increase in storage period with lowest in hands, wrapped with polyolefin 15µ. It was noticed that, shrink film increased the shelf life and maintained the quality of banana fruits for 14 days, under ambient conditions.

***KEYWORDS:** Chakkerkeli, Fingers, Hands, Physiological Parameters, Shrink Wrapping, Polyolefin 15µ & Cryovac 9µ*

Original Article

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INTRODUCTION

Banana (*Musa* sp.) is a large perennial herb with leaf sheaths that form trunk like pseudo stem. Banana is a globally important fruit crop with 97.5 million tons of production. Banana is a rich source of carbohydrate and vitamins. Banana powder is being used as one of the ingredients of baby food.

Bananas are generally harvested early in the season at a pre-mature stage to capture early market. Fruit production has increased but the post-harvest losses are not controlled. In a tropical country like India, these losses occur due to various reasons like lack of proper storage facilities, improper handling during long distance transport and rapid ripening due to high temperature followed by microbial spoilage. Banana being a highly perishable fruit, shows high post-harvest losses to the extent of about 20-30%, Sreenivasa *et al.* (2009).

The increased production of banana is supplemented with efforts to minimize post-harvest losses, by adopting a suitable technique with proper storage conditions. Shrink wrapping produces a micro atmosphere and retard ripening, by limiting the exchange of oxygen and carbon dioxide and can interplay with the physiological processes of commodity, resulting in reduced rate of respiration, transpiration and other metabolic processes of fruits, thereby allowing lower physiological weight loss, reducing decay incidence and maintaining retention of colour and texture of fruits, during extended shelf life, Sharma *et al* (2010).

MATERIALS AND METHODS

Matured banana bunches (Variety: *Chakkerkeli*) were separated into banana fingers and hands, uniform sized fruits were selected. Diseased, bruised, ripened and cracked fruits were discarded. The fruits were cured with hot water (50ºC for 10 min) and then shade dried at room temperature, to remove adhered moisture. Cured fruits were shrink wrapped in different heat shrinkable films(Polyolefin 15µ and Cryovac 9µ) and then stored under suitable storage conditions (Temp = 33°C; RH 72%).

Data on weight loss, firmness, colour were recorded on alternate days, whereas, percent decay and the CO2 transmission rate were recorded at three-day interval of 15 days.

Physiological Loss of Weight

Physiological loss of weight for each treatment was calculated by the following formula.

$$\% \text{ PLW} = \frac{\text{Initial weight} - \text{Final weight}}{\text{Initial weight}} \times 100$$

Firmness

Fruit firmness was evaluated twice on each fruit at alternate days using fruit firmness device (Wagner, model FT-327).

Measurement of Colour by Hunter Lab Colour Flex Meter

The colour of banana samples was measured using Hunter lab colour flex meter (M/s. Hunter lab, Reston, VA, USA; model CFLX-45). The surface colour was quantified in terms of L^*, a^* and b^* values of CIELAB colour space. Colour index (*CI*) of the sample was measured by measuring L^*, a^* and b^* values and was calculated, using the following equation as suggested, by Soltani *et al.* (2011b).

$$\text{Colour index} = 1000\, a^* / L^*\, b^*$$

Decay (%)

Percentage decay was determined as percentage of infected banana fruit in relation to the total number of fruits and was calculated using equation given, by Embaby *et al.* (2013).

$$\text{Decay } (\%) = \frac{\text{Numberofdecayfruits}}{\text{Total number of testing fruits}} \times 100$$

CO_2 Transmission Rate

The CO2transmission rate in the packed samples was evaluated at regular intervals, using a head space gas analyzer (PBI Dan sensor, model Checkmate II).

Statistical Analysis

The experiment was laid out in the Complete Randomized Design (CRD) and the data gathered were statistically analyzed using WASP (web agriculture statistical package).

RESULTS AND DISCUSSIONS

Physiological loss of weight of *Chakkerkeli* bananas wrapped in different heat shrinkable films increased with the increase in storage period (Figure.1). Hands wrapped with polyolefin 15µsignificantly recorded the lowest loss of weight. Unwrapped fingers recorded the highest loss of weight during the storage period. The moisture loss rate was faster in control, compared to the shrink wrapped samples. Reduction in PLW may be primarily due to the reason that the material acts as a barrier to moisture loss and also creates high relative humidity around the fruit thereby retarding the moisture loss during storage. Similar results were reported by Rashid *et al.* (2012) in 'milk' banana.

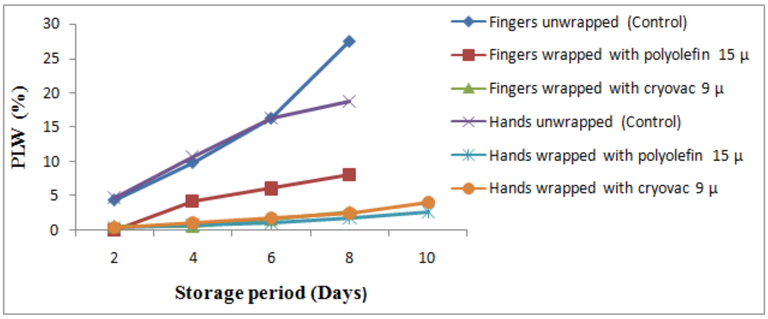

Figure 1: Effect of Heat Shrinkable Films on PLW (%) of Chakkerkeli Bananas

A gradual decline in firmness in film packed fruits was noticeable with advancement of storage period, whereas in control package the decline in fruit firmness was found to be abrupt and fast (Figure.2). *Chakkerkeli* hands wrapped with polyolefin had higher firmness. The decrease in firmness in all the treatments was caused by softening of the fruit, due to conversion of insoluble proto pectin into soluble pectin. Also, when the fruit started ripening as a result of which, cell wall integration is distributed, which lowered down the fruit texture during the storage. A similar trend was observed by Tapre *et al.* (2012) in 'Robusta' banana.

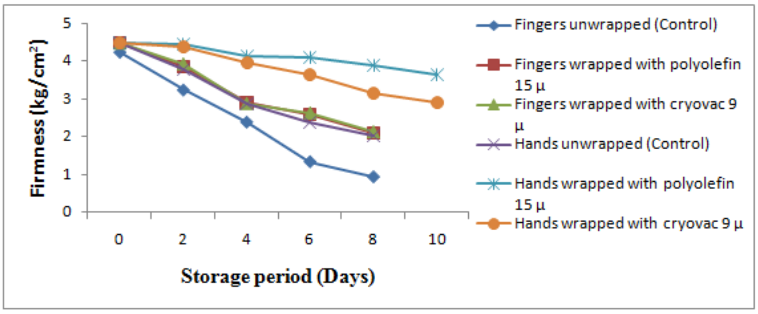

Figure 2: Effect of Heat Shrinkable Films on Firmness of Chakkerkeli Bananas

The shrink wrapped bananas showed a gradual colour change from green to yellow (Figure.3). The colour change in unwrapped treatments is more rapid than the wrapped treatments. The results revealed that, polyolefin 15µ had delayed colour changes and slowed down yellowing of the banana. Colour-break is the visual manifestation of the fruit ripening where peel colour changes from green to golden yellow, which is mainly attributed due to breakdown of chlorophyll pigments in the peel tissue.

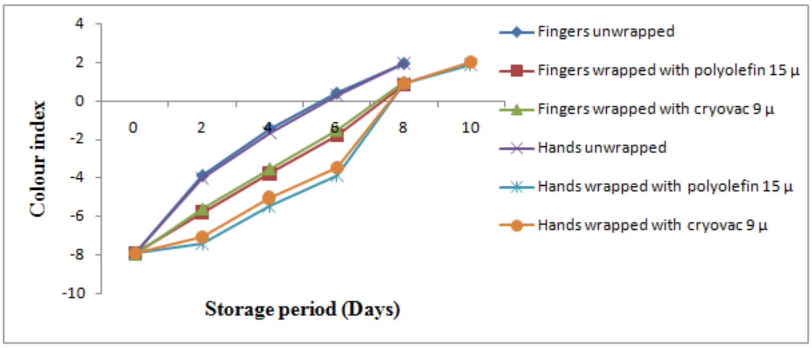

Figure 3: Effect of Heat Shrinkable Films on Colour Index of Chakkerkeli Bananas

Decay percentage of *Chakkerkeli* bananas increased with increase of storage period. But, the rate of decay was slow in shrink wrapped treatments (Figure.4). *Chakkerkeli* hands wrapped with cryovac 9µ recorded the highest decay of 45.71% and the lowest 31.4% was recorded, with polyolefin 15µ wrapped hands. Increase in the decay of fruits was attributed due to rapid senescence, followed by fungal development on the surface of fruits. Similar results were observed by Nazmy *et al.* (2012), in pomegranate fruits.

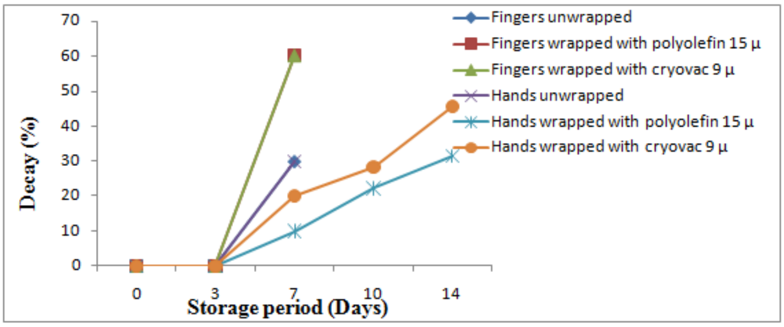

Figure 4: Effect of Heat Shrinkable Films on Decay (%) of Chakkerkeli Bananas

CO_2 transmission rate (%) increased in all the treatments with the increase in storage period (Figure.5). The highest value was significantly recorded with unwrapped hands and lowest value was found with hands wrapped with polyolefin 15µ. A similar trend was observed by Dhall *et al.* (2010). Shrink wrapped banana had a lower transmission rate than unwrapped banana with the lowest CO2transmission rate in hands wrapped with polyolefin 15µ. The lower transmission rate in shrink wrapped treatments might have delayed ripening by creating modified atmospheric conditions inside the wrapped fruits.

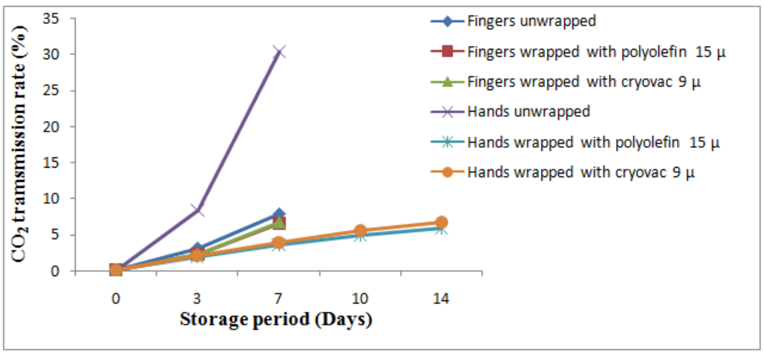

Figure 5: Effect of Heat Shrinkable Films on CO2 Transmission Rate of Chakkerkeli Bananas

CONCLUSIONS

The present study envisaged that, hand wrapped with polyolefin 15 μ retained higher values, for most of the physiological parameters studied under ambient storage conditions (72% RH, 33°C). Heat shrinkable packaging film can prolong the shelf life of *Chakkerkeli* bananas, up to14 days with acceptable quality.

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